

Bridge-to-Corn-Ethanol Subcontract Summary Sheet  
Purdue University, Laboratory of Renewable Resources Engineering  
(LORRE)

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**Industrial Partner:** Williams Energy Services Pekin, IL

**Other Partners:** USDA NCAUR Peoria, IL

**Starch to Ethanol Process Information**

**Feedstock:** Corn

**Facility Capacity:** 108,000,000 gal/yr

**Ethanol Yield** 2.50 gallons/bushel

**Other Products:** Corn oil/germ, Fiber, Gluten (Protein)

**Biomass Process Information**

**Size of Biomass Process:** 8.2 MM gal/yr = 495 dry US tons / day = 450 dry metric tonnes / day

**Ethanol Yield:** 47.5 gal / dry ton

**Feedstock:** Corn Fiber

**Process:** Hot Water Pretreatment and Enzymatic Hydrolysis

**Fermentative Organism:** Yeast

**Steam:** Produced on-site by ??? (assumed to be natural gas boiler)

**Electricity:** ?? (I assume all is purchased)

**Other Information:** Cellulase enzyme is to be purchased from an external supplier (Genencor)

**Links with Existing Facility**

The biomass process is a retrofit to the existing wet-mill facility, therefore, it utilizes almost all of the existing facility. Specifically, existing fermentation trains, distillation, infrastructure, and labor are shared.

**Capital and Operating Costs**

**Biomass Plant Capital Investment:** \$7.3 MM - \$11.7 MM = \$1.10 / annual gallon

**Total Operating Costs:** actual operating cost is not yet complete (estimated to be \$0.65 - \$0.75)

**Feedstock Cost:** \$65 / dry ton = \$0.55 / gal ethanol (based only on incremental fiber converted to ethanol)

**Chemical and Disposal Cost:** Unknown at present time; \$0.0387 / gal ethanol for purchased cellulase

**Proforma**

**Comparison of yearly value of fiber if none pretreated with yearly value of incremental ethanol sales & incremental energy costs (Fermenting C6 sugars and oligomers):**

Yearly value of Fiber if none pretreated (@ \$65/ton): \$9.9 MM

Yearly value of Incremental Ethanol Sales (@ \$1.00/gal): \$10.8 MM

Yearly Incremental Cost of Energy in Distillation (@ \$5/mm btu): \$0.8 MM

**Ethanol Selling Price:** \$1.00 / gal

**Plant Life:** N/A (10 years SL depreciation used to annualize the capital costs)

**Financing:** N/A

**Depreciation:** 10 year straight line

**Sensitivity Analysis**

Feedstock Cost vs. Production Cost of ethanol (\$40/ton - \$100/ton)

Capacity vs. additional capital and operating costs (varying fermentabilities used)

Energy cost vs. Ethanol Production Cost (\$1.80, \$2.50, \$5.00/mm btu)

Alternate process design configurations vs. production, capital and operating costs

Corn stover solids percentage vs. production, capital and operating costs (15% and 40%)

### **Strengths of Subcontract**

Corn fiber compositions & market prices  
Reliable vendor quotes for plate and frame heat exchangers  
Hot water pretreatment operating conditions specified  
Various wet-milling process configurations explored and diagrammed

### **Subcontract Recommendations/Next Steps**

Determine additional operating costs  
Test equipment and operating conditions at 1/9<sup>th</sup> scale  
Confirm yields and costs  
Determine impact on secondary plant products  
Implement one fiber pretreatment train at Pekin facility  
Select microorganism for pentose fermentation